DOCUMENT RESUME

ED 223 204 IR 010 455

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TITLE Level of Reading Comprehension and Achievement with Visualized Instruction.
PUB DATE May 82
NOTE 10p.; Paper presented at the Annual Meeting of the Association for Educational Communications and Technology, Research and Theory Division (Dallas, TX, May 1982). For other papers, see IR 010 442-487.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Audiovisual Aids; *Autoinstructional Aids; Instructional Design; Instructional Materials; Intermode Differences; Media Research; *Pictorial Stimuli; Programed Instructional Materials; *Reading Ability; Reading Comprehension; Realism; *Visual Learning
IDENTIFIERS *AECT Research and Theory Division Meeting; *Stimulus Complexity

ABSTRACT

The influence on learning of visuals accompanying self-paced text materials was investigated for students of varied reading comprehension ability levels. The use of varied degrees of realism and media presentation formats in facilitating learning on specific tasks was examined in order to clarify previous research, and to provide specific presentational guidelines for instructional designers considering a self-paced format. Programmed booklets with varied numbers of periodic review questions and answers and an additional audiotape were used to represent three levels of media presentation. Four levels of visual realism were studied: (1) no visuals; (2) line drawings; (3) shaded, detailed drawings; and (4) realistic pictures. Three levels of reading comprehension were identified for the 332 subjects. Visualization did not automatically result in improved achievement on different educational tasks for students of different reading comprehension abilities. The study demonstrated that individuals achieve at a different level of performance depending on the method of instructional presentation, the type of visuals accompanying printed instruction, and the level of reading comprehension. Further studies are necessary to provide the basis for detailed guidelines for developing self-paced visualized instruction. (LMM)

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LEVEL OF READING COMPREHENSION AND ACHIEVEMENT WITH VISUALIZED INSTRUCTION

by

Perrin E. Parkhurst

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LEVEL OF READING COMPREHENSION AND ACHIEVEMENT WITH VISUALIZED INSTRUCTION

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PROBLEM

The increased demand for self-paced courseware, applicable to diverse audiences, has presented many problems for instructional designers. The problem investigated in this study centered around defining guidelines for instructional materials designers, to use when developing courseware that uses visuals in a self-paced format. More specifically, the following four research questions were addressed:

1. Is the same degree of realism in visuals, accompanying self paced text materials equally effective in facilitating achievement, when students differ in level of reading comprehension?
2. Are different media presentation strategies equally effective in facilitating achievement for students who differ in level of reading comprehension?
3. Is achievement on a particular educational task facilitated either by degree of realism in visuals or a media presentation format, for students who differ in level of reading comprehension?

RELATED LITERATURE

Overview:

Little is known about the processes used by individual learners as instructional information is being internalized and "learned." Three theoretical frameworks provide the basis for this study of individual differences: the "realism researchers," the "sense modalities" studies, and the "text organizational format" studies.

Realism Continuum:

This study has as one theoretical framework, the works of the "realism researchers," Dale (1946), Morris (1946), Carpenter (1953), and Gibson (1954). In brief, their thesis was that as instructional materials became more realistic, they tend to be more effective. Travers (1967) (1970) and Dwyer (1967) (1972) found evidence suggesting that this generalization does not hold for all levels of educational tasks. Expanding on that research, Goldberg (1974), Levin et al. (1974), and Peeck (1974), have studied such phenomena as: the effect of imagery on learning incidental material; individual differences in learning from pictures and words; and retention of pictorial and verbal content.

Single and Multiple Channel Presentation

Research into sense modalities and the human's ability to process information received via several channels provided another theoretical framework. Evidence by Broadbent (1958) (1965), Miller (1956), and Hartman (1961) indicate that humans are basically limited channel process beings. That is they are unable to filter, process, and store information presented via multiple sense modalities.

"Simultaneous audiovisual presentation of words (with visuals) is not superior to learning from print alone, but when pictures are presented in the visual channel, more learning may (emphasis added) result from audiovisual presentations under certain conditions which are not fully defined or understood" (Travers, 1973, p. 873).

Text Material Presentation Strategies

Self-paced mediated strategies can take many forms; for example, filmstrips with and without adjunct questions, programmed booklets, variable speed audio tape playback units, computer assisted instruction with infinite branching capabilities, and many others. The work done in the area of presenting questions with text material by Rothkopf (1965) (1970), Frase (1968a) (1968b), Anderson (1970), Boker (1974), Shavelson et al. (1974), and Koran and Koran (1975) weighed heavily in the decision to use the "method of presentation" format described as Factor "A" in the next section.

Generally their work may be summarized by saying that,

1. Retention increases with an increase in the frequency of post-questions; that is, questions inserted shortly after the instructional information.
2. An increased frequency of postquestions facilitates both relevant and incidental learning.
3. Very specific questions are more effective than general questions.

This study then was an attempt to (1) assist in resolving the dilemma of the realism researchers and (2) provide specific presentational guidelines for instructional designers contemplating a self-paced format.

PROCEDURE

Design:

A three factor multivariate analysis of variance was used, with five levels of a repeated measure.

Independent Variables

Factor A was the "media presentation" variable. There were three levels: (1) programmed booklets with periodic review questions and answers after approximately every 10 frames; (2) same as #1 with additional questions and answers after each frame; and (3) same as #2 with printed instructional material simultaneously presented on audiotape.

Factor B was the "visual realism" variable. There were four levels: (1) no visuals; (2) line drawings; (3) detailed shaded drawings; and (4) realistic pictures of the object.

Factor C was the "individual difference" variable (level of reading comprehension). There were three levels: (1) high; (2) medium; and (3) low.

Dependent Variables:

The five levels of the dependent variable (achievement) were: (1) a drawing test; (2) an identification test; (3) a terminology test; (4) a comprehension test; and (5) a total score (above four tests combined). All scores were standardized to a "T" score prior to data analysis.

SUBJECTS

Students (n = 332; 250 females and 82 males) were given the 1973 Iowa Silent Reading Test and then randomly assigned to treatment groups of Factor A and B. After the Iowa Silent Reading Test was scored, a post hoc randomization procedure was used on the individual difference variable (reading comprehension portion of the test). Reading comprehension was selected as the individual difference variable of interest, because it was believed to be the element of I.Q. most closely related to other factors under study. Cells were adjusted to attain proportionality and a multivariate analysis of variance was conducted, both on an immediate posttest and a four week delayed posttest.

ANALYSIS

According to Lindquist (1953), Kirk (1963), and Games (1971), the generally accepted procedure to follow for four factor multivariate analysis is to first test the four-way interaction, using an F test. If significant, do follow-up tests on the four factor interaction, report the results and stop. If nonsignificant, test the three-way interactions, using an F test. If significant, do follow-up T tests on the three factor interaction (averaged over the non interacting factor), report the results and stop. The procedure continues with the same rationale for the two factor interaction and main effects.

RESULTS

On the immediate posttest analysis of variance, there was a significant three-way (reading comprehension, visual realism, achievement) interaction ($p < .05$). On the delayed posttest analysis of variance, there was a significant three-way (reading comprehension, method of presentation, achievement) interaction ($p < .01$). Follow up tests were conducted on those significant interactions only.

Immediate Posttest

Any assumption by instructional materials designers that there are no differences in achievement on different educational tasks among students who differ in levels of reading comprehension and instructional treatments using visuals varying in degree of realism is not supported by the results of this study. Furthermore, the use of visualization did not automatically result in improved achievement on different educational tasks for students who differed in level of reading comprehension.

Delayed Posttest

The results of this study do not support any assumption by instructional materials designers that there are no differences in achievement on different educational tasks among students who differ in level of reading comprehension and method of self-paced instruction received. That is, for students who differed in level of reading comprehension, the cumulative effect of adding information channels (redundancy of presentation stimulus and feedback) either facilitated or inhibited achievement depending on the educational tasks involved.

CONCLUSIONS

Immediate Posttest

1. Not all visuals were equally effective in facilitating student achievement on different educational tasks.
2. Not all students who differed on level of reading comprehension achieved at an equal level of performance on identical criterion measures when different visuals were available.
3. On most of the educational tasks, the simple or less realistic visuals reduced the overall significant differences in achievement between the high, medium, and low level of reading comprehension.
4. The high level reading comprehension group achieved their lowest performance on all educational tasks when they received line drawings.
5. The high level reading comprehension group's achievement improved as the degree of realism in visuals increased from line drawings to detailed shaded drawings to realistic model.
6. The low level comprehension group's achievement decreased as the degree of realism in visuals increased from no visuals to realistic model.
7. The pattern of student achievement for the medium level reading comprehension group was inconsistent and irregular on each of the educational tasks as the amount of visual realism increased from no visuals to realistic model.

Delayed Posttest

1. Not all methods of presenting instructional information were equally effective in facilitating student achievement on different educational tasks.
2. The use of questions and answers as a method of presentation factor, to focus student attention on relevant information, is an effective way to facilitate retention of that information for the low level reading comprehension group.
3. The added dimension of audiotape as a supplement to printed instruction does not automatically improve the effectiveness of that instruction for students who differ on level of reading comprehension.
4. Not all students who differed on level of reading comprehension achieved at an equal level of performance on identical criterion measures when different methods of presenting instructional information were used.
5. On all educational tasks except that measured by the comprehension test, the method of presentation consisting of review questions and answers periodically, plus questions and answers after each frame (A_2) reduced the existing significant differences between the three levels of reading comprehension.
6. Students at the low level of reading comprehension improved moderately, although not significantly, on all of the educational tasks when the method of presentation contained the added stimulus of questions and answers after each frame (as compared to review questions and answers periodically.
7. Students in the high level reading comprehension group improved their performance as each method of presentation cue was added to the previous one.
8. The pattern of student achievement for the medium level of reading comprehension group differed significantly from the high group only when the added stimulus of audiotape was presented. This significance occurred only on the drawing and identification tests and is attributed to the high level group's increase in student achievement, contrasted with the medium level group's decrease in student achievement.

FURTHER RESEARCH TOPICS

The findings of this study raise several questions and possible research topics which must be answered before any theory of instruction may be advanced.

1. Is it possible to measure the degree or extent to which students actually interact with a visual when it is present in visualized instruction?
2. Would postquestions which require a visual response rather than a printed response facilitate achievement on different kinds of educational tasks?
3. Is it possible to measure the amount of information which is actually extracted from a visual stimulus accompanying printed instruction?
4. Do further extremes on the selected individual difference variable; e.g., higher highs and lower lows, produce any different results?

5. Is it possible to devise an instructional unit which requires students to interact with visuals?
6. When instructional content is presented via audiotape, is there any difference between the presence or absence of a) identical printed narrative and/or b) visuals which differ in degree of realism?
7. Are there other individual difference variables which would produce stronger interactions or more easily interpretable results?
8. It is strongly recommended that research be conducted which attempts to increase the construct validity of identifying such individual difference variables as high visual imagers, low visual imagers, high auditory attenders, and low auditory attenders, etc. That is, place added emphasis on identifying, validating, and implementing the variables which will facilitate an understanding of the information gathering processes which human beings use when they interact with visualized material.

This exploratory study of the effectiveness of self-paced visualized instruction has demonstrated that individuals achieve at a different level of performance depending on (1) the method of presenting instructional content, (2) the type of visuals accompanying printed instruction, and (3) the level of reading comprehension. Further studies of the kind suggested are necessary before detailed guidelines for developing self-paced visualized instruction may be set forth.

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